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BCG VACCINATION IN HOSPITALS AND SANATORIA OF SASKATCHEWAN

A Study Carried Out by the National Research Council of Canada

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SINCE the discovery of the tubercle bacillus by Koch six decades ago, tuberculosis death-rates, case-rates and infection have fallen.

Side by side with spectacular success in protecting the public, we have observed the sad spectacle of the unabated breakdown of persons caring for the tuberculous sick. This became particularly noticeable in Saskatchewan in the early "thirties" among sanatorium nurses and attendants and nurses-in-training in hospitals. Phthisiophobia was developing among sanatoria employees and student nurses, and their tuberculosis-conscious relatives were restive. The condition threatened the efficient prosecution of the anti-tuberculosis campaign.

It was known that infection, as indicated by a positive tuberculin reaction, had fallen rapidly among Normal School students of the Province, from 76 per cent in 1921 to 23 per cent in 1931. These young teachers were known to originate from much the same family background as that of the student nurses, and were on this basis regarded as a comparable group in the matter of infectivity of home environment. Bearing this information in mind, it was considered that the rise in morbidity rate might be due to a larger proportion of negatively reacting persons entering the hospital and sanatorium environment. It was decided to check up on the preventive technique practised in these infectious environments and to introduce periodical tuberculin testing and X-raying of nurses in the eight larger hospitals and exposed nurses and other employees in the three sanatoria of the Province.

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The findings of this study after five years' observation were: (*a*) that about 80 per cent of each class of nurses entering training since 1934 have been negative to tuberculin; (*b*) that by far the highest incidence of tuberculosis occurred among exposed persons who had been negative to tuberculin on entering the environments; (*c*) it was also noted that despite improvement in instruction concerning preventive technique, and the provision of improved facilities for the practice of this technique, little or no improvement in the protection of the exposed persons appeared to have been accomplished.

A possible solution for the problem was suggested by a coincident experience. During the period 1933 to 1938 a controlled experiment in the protection of Indian infants by BCG vaccination, without segregation during vaccination, had been carried on in the Qu'Appelle Health Unit in Saskatchewan, under the direction of the National Research Council. As a result, it appeared that a reasonable measure of protection was afforded these infants by vaccination while they remained in the infectious environment of their homes on the Reserves ; the death rate from tuberculosis among the vaccinated infants as compared with the control infants was in the ratio of 1:4. In view of this fact, it was proposed to the Council that an attempt be made to afford a similar protection to unavoidably exposed nurses and sanatoria employees in Saskatchewan, by means of BCG vaccination without segregation during the process of vaccination, that is, BCG vaccine to be administered after the negative reactor entered the infectious environment and while on duty. This proposal was accepted by the Council and as a result the work of vaccination was started in September, 1938.

Heimbeck, in a personal communication dated June, 1938, summarized his results with BCG vaccination up to May, 1938. He had been studying prophylactic vaccination with BCG at the Ullevaal Communal Hospital in Oslo since 1927. His observations were that the incidence among vaccinated nurses who became positive from vaccination had been much lower than among non-vaccinated negative controls. Among 341 made positive to tuberculin by vaccination there were 12 diseased and no deaths; while among 284 non-vaccinated negative controls there were 97 diseased and 12 deaths; among 668 nurses entering training with a positive tuberculin there were 22 diseased and no deaths.

It was considered that BCG vaccination of unavoidably exposed persons in the environments of the Saskatchewan General Hospital, where 35 per cent of all negative reacting nurses became infected during the training period, and in the Saskatchewan Sanatoria, where the rate of infection of certain groups of employees for the first year of exposure was 60 per cent, would test the efficacy of this prophylactic.

In endeavoring to obtain suitable controls, the advice of the National Research Council's Panel on Tuberculosis was sought. Since during the period of vaccination there would be relatively few nurses and sanatoria employees entering the Saskatchewan institutions who would not be vaccinated, the Panel was unable to suggest a wholly comparable group of adequate size. It was recommended that a comparison be made of the experience of the vaccinated with that of similar non-vaccinated negative persons entering the Saskatchewan institutions during the five-year period immediately preceding

the initiation of vaccination, making due allowance for changing conditions. It had also been hoped that the trend in tuberculosis infection during a decade in the Saskatchewan institutions could be compared directly with that in the Winnipeg General Hospital, where vaccination was not practised, but changes in the schedule of training in the latter made this inadvisable and, as a result, conclusions had to be based on a comparison of morbidity statistics, with due recognition of the difference existing between the groups. This course has been followed, but because true controls, in the accepted sense of the word, could not be obtained in sufficient number, that term will not be used in the balance of this paper and reference will be made only to vaccinated and non-vaccinated negatives. The principles recommended by the Panel on Tuberculosis for the selection of cases and the treatment of the results obtained have been adopted.

The significance of the data was assessed by Bogen's method (1). The BCG vaccine used was prepared by Dr. Armand Frappier, Director of the Institute of Microbiology and Hygiene of the University of Montreal. The dose given was 0.2 mg. of BCG in 0.2 cc. solution; 0.1 mg. administered intracutaneously at each of two sites on the upper arm or thigh. Vaccination was instituted on the basis of a signed request by the individual desiring vaccination. Information up to March 31, 1945 is embodied in all these studies.

Experience in Eight Saskatchewan General Hospitals

All nurses entering training in these eight hospitals in the years 1934 to 1943, inclusive, are included in the study.

The unusual significance of this study arises from the fact that all were females; the age of both vaccinated and non-vaccinated is considered a susceptible period, being age 20; the infectivity of the environment and period of exposure in the environment, probably the two most fundamental factors, are very comparable. There was no evidence that contact with tuberculosis prior to entering training was a significant factor.

The infectivity of the environment as shown by the non-vaccinated negatives has been relatively stable during the entire period (see table I). The year-by-year incidence of infection throughout the three years of training remained quite comparable for each class that entered training, being 11.5, 12.7 and 11.2 per cent, respectively, for the first, second and third year of training. The probable sources of infection are indicated by the record of the number of patient-days for the treatment of tuberculosis in these eight hospitals (see table II). (These eight hospitals have been used as overflow accommodation for the treatment of tuberculosis throughout the period.) All treatment for tuberculosis being free to the sick in Saskatchewan and paid for by the League, it is assumed that this is a fair index.

The average periods of exposure to the environment of all groups are relatively quite comparable, being 2.42 years, 2.54 years and 2.47 years, for the vaccinated, non-vaccinated negatives and positive groups, respectively.

The general conditions of the environments studied have been quite stable. Matters of food, working and living conditions to which the exposed persons have been subjected have not varied appreciably throughout the period of time covered by the studies.

TABLE I

INCIDENCE OF INFECTION OF NON-VACCINATED NEGATIVES IN HOSPITALS
(Using only those negatives who had satisfactory tuberculin information)

YEAR OF ENTERING TRAINING	1934	1935	1936	1937	1938	1934–1938	1939	1940	1941	1942	1943	1939–1943	1934–1943
Eight Saskatchewan Hospitals:													
Number negative to tuberculin on entrance	62	93	131	152	180	618	21	23	24	5	1	74	692
Number becoming positive to tuberculin during training	30	39	45	57	44	215	10	8	6	2	1	27	242
Percentage becoming positive to tuberculin during training	48.4	41.9	34.4	37.5	24.4	34.8	47.6	34.8	25.0	40.0	100.0	36.5	35.0
Winnipeg General Hospital:													
Number negative to tuberculin on entrance	46	54	35	41	50	226	59	53	53	60	82	307	533
Number becoming positive to tuberculin during training	26	31	15	21	25	118	27	16	13	14	9	79	197
Percentage becoming positive to tuberculin during training	56.5	57.4	42.9	51.2	50.0	52.2	45.7	30.2	24.5	23.3	11.0	26.0	37.0

INFECTION RATE OF NON-VACCINATED NEGATIVES YEAR BY YEAR DURING TRAINING IN EIGHT SASKATCHEWAN HOSPITALS
Based on remainders

YEAR OF ENTERING TRAINING	1934	1935	1936	1937	1938	1934–1938	1939	1940	1941	1942	1943	1939–1943	1934–1943
Number negative to tuberculin on entrance	62	93	131	152	180	618	21	23	24	5	1	74	692
Number becoming positive to tuberculin in first year of training	7	10	16	7	22	62	9	3	5	1	—	18	80
Per cent becoming positive to tuberculin in first year of training	11.3	10.75	12.2	4.6	12.2	10.0	42.9	13.0	20.8	20.0	—	24.3	11.5
Number remaining negative after first year's exposure	55	83	115	145	158	556	12	20	19	4	1	56	612
Number becoming positive to tuberculin in second year of training	6	9	13	27	17	72	1	3	—	1	1	6	78
Per cent becoming positive to tuberculin in second year of training	10.9	10.8	11.3	18.6	10.76	12.95	8.3	15.0	—	25.0	100.0	10.7	12.7
Number remaining negative after two years' exposure	49	74	102	118	141	484	11	17	19	3	—	50	534
Number becoming positive to tuberculin in third year of training	10	8	11	23	5	57	—	2	1	—	—	3	60
Per cent becoming positive to tuberculin in third year of training	20.4	10.8	10.8	19.5	3.55	11.8	—	11.8	5.3	—	—	6.0	11.2
Number remaining negative after three years' exposure	39	66	91	95	136	427	11	15	18	3	—	47	474
Number requiring over three years to become positive to tuberculin	7	12	5	—	—	24	—	—	—	—	—	—	24
Per cent requiring over three years to become positive to tuberculin	17.9	18.2	5.49	—	—	5.62	—	—	—	—	—	—	5.1

It would seem from the above that known factors, other than vaccination, which might influence the cases in regard to developing disease are comparable.

TABLE II

SHOWING KNOWN SOURCES OF INFECTION IN EIGHT SASKATCHEWAN HOSPITALS

This table shows days of treatment for tuberculosis paid for by the League in the eight Hospitals studied. Also shown are the average number of tuberculosis patients in these hospitals, as well as the white death-rate from tuberculosis in Saskatchewan for the period studied.

Year	Average number of tuberculosis patients	Treatment days for tuberculosis in eight hospitals studied	White tuberculosis death-rate per 100,000 population
1934	38	13,836	23.0
1935	25	9,263	22.7
1936	33	11,996	22.2
1937	16	5,807	22.2
1938	22	8,156	19.2
1939	38	13,828	16.2
1940	32	11,496	17.1
1941	42	15,501	20.2
1942	48	17,428	16.8
1943	32	11,619	21.0
1944	55	20,091	17.2

Although there has been fluctuation in treatment days for tuberculosis patients in the tuberculosis wards maintained in the eight Saskatchewan Hospitals during the period studied, they have been relatively constant with the exception of the years 1935, 1937 and 1938. As will be noted from table I, the incidence of infection during the entire period has been relatively constant.

There were 2,042 cases accepted for study (see table III).

Findings: Among 1,005 vaccinated cases there were 9 who developed manifest tuberculosis, or 0.895 per cent (the term manifest tuberculosis used throughout this study means pulmonary tuberculosis demonstrable by X-ray, and non-pulmonary cases of tuberculosis as seen in table IV); among 759 negative non-vaccinated cases there were 29 who developed manifest tuberculosis, or 3.82 per cent; among 278 cases positive to tuberculin on entrance, there were 3 who developed manifest tuberculosis, or 1.08 per cent.

The difference in percentages between the vaccinated and the non-vaccinated negatives is 2.925 per cent, which is 5.8 times its own probable error, and therefore of statistical significance. The ratio is 1:4.27.

EXPERIENCE IN THE WINNIPEG GENERAL HOSPITAL, WINNIPEG, MANITOBA

BCG vaccination was not carried on in the Winnipeg General Hospital, and nurses entering training in this hospital during the period of 1934 to 1943, inclusive, were studied as a comparable non-vaccinated negative group for the above Saskatchewan study.

Since 1937 the hospital has discontinued the custom of sending nurse negative to tuberculin to the King Edward Sanatorium for affiliate trainin

in tuberculosis nursing. Since 1939 the hospital has practised increased segregation in regard to tuberculosis—the Central Tuberculosis Clinic has been called on for consultation whenever a patient admitted to the hospital was suspected of having tuberculosis. If on examination the patient was found to be tuberculous he was immediately removed to the wards of the tuberculosis clinic. This segregation has had the effect of reducing appreciably the infectivity of the environment. In the classes entering since 1940 the infectivity has fallen from an average of about 50 per cent infected during training in the preceding classes to an average of 25 per cent infected during training. How-

TABLE III

BCG Vaccination Among Nurses in Hospitals
Nurses Entering Training—Period 1934-1943

Accepted for study	Number of persons	Tuberculosis cases	Per cent with Tuberculosis	Probable error	Years observed	Average years observed
Nurses in eight Saskatchewan Hospitals:						
BCG vaccinated nurses.....	1,005	9	0.895	±0.2	2,434.4	2.42
Negative to tuberculin on entrance–non-vaccinated	759	29	3.82	±0.46	1,926.9	2.54
Positive to tuberculin on entrance.....	278	3	1.08	±0.42	688.1	2.47
Total in eight Saskatchewan Hospitals–1934 to 1943...	2,042	41	2			
Nurses in Winnipeg General Hospital:						
Negative to tuberculin on entrance—non-vaccinated	609	26	4.26	±0.55	1,392.53	2.28
Positive to tuberculin on entrance.....	200	2	1.0	±0.47	477.1	2.39
Total in Winnipeg General Hospital–1934 to 1943....	809	28	3.46			
Saskatchewan Hospitals and Winnipeg General Hospital combined:						
BCG vaccinated nurses.....	1,005	9	0.895	±0.2	2,434.4	2.42
Negative to tuberculin on entrance–non-vaccinated	1,368	55	4.02	±0.36	3,319.4	2.43
Positive to tuberculin on entrance.....	478	5	1.046	±0.31	1,165.2	2.43
Total accepted for study in Saskatchewan Hospitals and Winnipeg General Hospital combined–1934 to 1943..... ..	..2,851	69	2.42			

ever, the average infectivity for the ten-year period 1934-1943 in both the Winnipeg General Hospital and the Saskatchewan Hospitals has been very comparable (see table I); 37 per cent of the negative non-vaccinated became

TABLE IV A

TYPE OF DISEASE OF CASES OF TUBERCULOSIS IN HOSPITAL STUDY ONLY
(Eight Saskatchewan Hospitals)

	Vaccinated group	Negative group	Positive group	Total cases
Pulmonary tuberculosis—parenchymal	5 (2)	11 (2)	3	19 (4)
Pulmonary tuberculosis —complicated by cervical adenitis	—	1	—	1
Pulmonary tuberculosis—progressing to contralateral lung and spine	—	1	—	1
Pleurisy with effusion only	3	7	—	10
Pleurisy with effusion progressing to parenchymal disease	—	3	—	3
Erythema nodosum only	1 (1)	2 (2)	—	3 (3)
Erythema nodosum progressing to pleurisy with effusion	—	3	—	3
Erythema nodosum progressing to parenchymal disease	—	1 (1)	—	1 (1)
Total cases of tuberculosis	9 (3)	29 (5)	3 (0)	41 (8)

Note: Figures in brackets denote cases *not treated;* that is, of the 9 cases of tuberculosis in the vaccinated group, 3 were not treated.

TABLE IV B

TYPE OF DISEASE OF CASES OF TUBERCULOSIS IN SASKATCHEWAN SANATORIA STUDY ONLY

	Vaccinated group	Negative group	Positive group	Total cases
Pulmonary tuberculosis—parenchymal	4 (2)	20 (7)	9 (6)	33 (15)
Pulmonary tuberculosis progressing to miliary tuberculosis and death	—	1	—	1
Pulmonary tuberculosis progressing to tuberculous ankle	—	1	—	1
Pleurisy with effusion only	4	4	—	8
Pleurisy with effusion progressing to parenchymal disease	—	1	—	1
Pleurisy without effusion	—	1	—	1
Erythema nodosum only	1	3 (1)	2	6 (1)
Erythema nodosum progressing to pulmonary tuberculosis	—	1	—	1
Cervical adenitis only	—	—	1 (1)	1 (1)
Renal tuberculosis	—	—	1	1
Total cases of tuberculosis	9 (2)	32 (8)	13 (7)	54 (17)

Note: Figures in brackets denote cases *not treated* in each group.

infected during training in the Winnipeg General Hospital, and 35 per cent of the negative non-vaccinated became infected during training in the Saskatchewan Hospitals. The average period of exposure to the environment of the negative and positive reactors was 2.28 years and 2.39 years, respectively, which closely approximates the average period of exposure in the Saskatchewan Hospital study. The general living conditions were found to be comparable with the Saskatchewan group. Average age on entrance was the same, being 20 years.

There were 809 cases accepted for study (see table III).

Findings: Among 609 non-vaccinated negatives in the Winnipeg General 26 developed manifest tuberculosis, or 4.26 per cent; among 200 positive reactors 2 developed manifest tuberculosis, or 1 per cent. Taking the Winnipeg General Hospital non-vaccinated negatives as a comparable group for the Saskatchewan vaccinated group, we find the difference in percentages is 3.365 per cent, which is 5.7 times its own probable error. The ratio is 1:4.8.

Combining both the Saskatchewan Hospital study and the Winnipeg General Hospital study for the purpose of comparing larger numbers, we find that the resultant average time of exposure to the environments for the vaccinated, non-vaccinated negatives, and positive groups is 2.426 years, 2.437 years and 2.43 years, respectively. Among 1,005 vaccinated cases there were 9 who developed manifest tuberculosis, or 0.895 per cent; among 1,368 non-vaccinated negatives there were 55 who developed manifest tuberculosis, or 4.02 per cent; among 478 positives there were 5 who developed manifest tuberculosis, or 1.046 per cent. The difference in percentages in comparing the vaccinated with the non-vaccinated negatives is 3.125 per cent, which is 7.6 times its own probable error. The ratio is 1:4.5.

It would seem, then, that the use of BCG vaccination in the hospital environment has reduced manifest tuberculosis among negative reactors to its fourth. Of the 9 cases of manifest tuberculosis in the vaccinated group, only 66.6 per cent required treatment, while in the 55 cases of manifest tuberculosis in the non-vaccinated negative group, 82.8 per cent required treatment.

An interesting observation regarding the developing of manifest tuberculosis among the negative non-vaccinated group is that roughly 80 per cent of the cases developing tuberculosis did so within a year of becoming infected (see table V).

There were no deaths from tuberculosis in any of these groups.

Experience in Three Sanatoria in Saskatchewan

The groups studied in the sanatoria were the vaccinated and non-vaccinated negatives and positives under the following occupations: graduate nurses, nurses' assistants, kitchen maids, orderlies and a miscellaneous group comprised of laundry staff, laboratory staff, X-ray staff and house maids, all of whom had a rate of infection higher than that experienced in the hospital environments studied above.

The first three occupational groups are of the female sex and of an average age of 23.3 years on entrance. The occupational groups, orderlies and miscellaneous, comprise both males and females and their average age is 24.3 years on entrance.

TABLE V

Time After First Positive Tuberculin to Appearance of Manifest Tuberculosis

Eight Saskatchewan Hospitals and the Winnipeg General Hospital Combined
Negative Reactors Only—Period 1934–43

Time in Months	1	2	3	4	5	6	7	8	9	10	11	12	13	16	32	62
Negative Reactors on Entrance Only	2	5	9	6	5	5	2	3	5	2	2	3	2	1	2	1
Number Cumulative	2	7	16	22	27	32	34	37	42	44	46	49	51	52	54	55
% total cases that developed Within one year after first positive												89%				

Time After Last Negative Tuberculin Test Prior to Appearance of Manifest Tuberculosis, to Appearance of Manifest Tuberculosis

Time in Months	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	20	24	26	31	32	36	38	48	88
Negative Reactors on Entrance Only	1	1	2	6	4	3	1	1	5	3	1	8	1	1	5	1	1	1	1	1	1	2	1	1	1	1
Number Cumulative	1	2	4	10	14	17	18	19	24	27	28	36	37	38	43	44	45	46	47	48	49	51	52	53	54	55
% of total cases that developed within one year of the last negative tuberculin test prior to appearance of manifest tubercuolsis												65.5%														

N.B. The probable mean percentage for manifest tuberculosis appearing within twelve months after receipt of infection is 77.2 per cent (assuming that midway between the last negative tuberculin test prior to appearance of manifest tuberculosis and the first positive tuberculin test lies the true date when person was first infected).

TABLE VI

BCG VACCINATION AMONG EXPOSED EMPLOYEES IN SASKATCHEWAN SANATORIA

Showing percentage developing manifest tuberculosis in each occupational group studied
(Employees entering sanatorium environment—period 1934-1943)

Accepted for study	Number of persons	Tuber-culosis cases	Per cent with tuber-culosis	Probable error	Years observed	Average years observed
BCG vaccinated employees:						
Nurses' assistants	143	4	2.8		163.48	1.14
Graduate nurses	60	1	1.67		54.78	0.925
Kitchen and diet kitchen maids	140	2	1.43		195.59	1.4
Orderlies and cleaners	69	1	1.45		70.28	1.02
Miscellaneous group	58	1	1.72		73.70	1.27
Total vaccinated	470	9	1.92	±0.42	557.83	1.19
Graduate nurses and nurses' assistants combined	203	5	2.46	±0.74	218.26	1.075
Negative to tuberculin on entrance–non-vaccinated:						
Nurses' assistants	54	10	18.5		74.15	1.37
Graduate nurses	59	8	13.54		45.68	0.774
Kitchen and diet kitchen maids	82	7	8.54		158.13	1.93
Orderlies and cleaners	38	4	10.5		54.33	1.43
Miscellanous group	41	3	7.32		62.86	1.53
Total negatives non-vaccinated	274	32	11.67	±1.31	395.15	1.44
Graduate nurses and nurses' assistants combined	113	18	15.9	±2.32	119.83	1.06
Positive to tuberculin on entrance:						
Nurses' assistants	99	4	4.04		135.28	1.37
Graduate nurses	194	7	3.61		232.94	1.2
Kitchen and diet kitchen maids	74	1	1.35		110.49	1.5
Orderlies and cleaners	60	—	—		130.41	2.17
Miscellaneous group	35	1	2.86		56.57	1.61
Total positives	462	13	2.81	±0.52	665.69	1.44
Graduate nurses and nurses' assistants combined	293	11	3.75	±0.74	368.22	1.25
Total:						
Nurses' assistants	296	18	6.08		372.91	1.26
Graduate nurses	313	16	5.1		333.40	1.06
Kitchen and diet kitchen maids	296	10	3.4		464.21	1.57
Orderlies and cleaners	167	5	3.0		255.02	1.52
Miscellaneous group	134	5	3.73		193.14	1.44
Total accepted for study	1,206	54	4.47	—		

General conditions in the sanatoria environment have remained much the same; matters of food, working hours and living conditions to which the exposed persons have been subjected have not varied appreciably throughout the period covered. All employees entering the environment during the period 1934 to 1943, inclusive, were considered; there were 1,206 accepted for study (see table VI).

The infectivity of the environment has remained high throughout the period of study, as would be expected. The incidence of infection among the

TABLE VII

SHOWING SOURCES OF INFECTION IN SASKATCHEWAN SANATORIA

Proportion of adult pulmonary cases with *positive sputum* in three Saskatchewan Sanatoria —as of December 31st of each year

Year	Total cases	Infectious cases	Percentage infectious
1934	504	422	83.7
1935	499	425	85.1
1936	516	455	88.1
1937	546	472	86.5
1938	562	456	81.1
1939	569	455	79.9
1940	587	449	76.5
1941	610	443	72.6
1942	550	435	79.1
1943	582	425	73.0
1944	593	471	79.3

This table is an indication of the relative constancy of sanatorium environment under consideration during the period of this study. It will be noted that, although the percentages of positive sputum cases vary downward to some extent, the actual number of infectious cases remains relatively constant throughout the ten-year period.

non-vaccinated negatives remained reasonably stable, being 74.2 per cent in the period 1934-1938 and 70.3 per cent in the period 1939-1943. The probable sources of infection are indicated in table VII, which shows the number of cases year by year with positive sputum who were treated in the sanatoria.

The average time of exposure for the various groups, vaccinated, non-vaccinated negatives, and positives, was 1.19 years, 1.44 years and 1.44 years, respectively; the time factor is not entirely comparable, the vaccinated group having on the average three months' less exposure to the environment than either the non-vaccinated negatives or positive groups.

The rate of infection in the sanatoria environment for the first year of exposure as shown in table VIII is 60 per cent. This rate appeared high, so it was checked with that obtaining in the Manitoba Sanatorium and the St. Boniface Sanatorium and was found to be comparable.

Vaccination in such an environment will be put to a severe test and the findings regarding the efficacy of vaccination under these conditions should have considerable weight.

Findings: Among 470 vaccinated persons in the occupational groups mentioned previously, 9 developed manifest tuberculosis, or 1.92 per cent. We

TABLE VIII

INCIDENCE OF INFECTION OF NON-VACCINATED NEGATIVES IN SASKATCHEWAN SANATORIA

Showing percentages infected in three-month periods—based on remainders
(Using only those negatives who had satisfactory tuberculin information)

	3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.	24 mos.	30 mos.	30+ mos.	Total
Nurses' assistants										
Total negative....	47	39	22	14	12	10	8	6	6	47
Number infected....	8	17	8	2	2	2	2	—	—	41
Per cent infected....	17.0	43.5	36.3	14.3	16.6	20.0	25.0	—	—	87.2
Cumulative number infected.....	8	25	33	35	37	39	41	41	41	41
Cumulative per cent infected.....	17.0	53.2	70.2	74.5	78.7	83.0	87.2	87.2	87.2	87.2
Graduate Nurses										
Total negative.....	45	40	22	15	14	14	14	14	13	45
Number infected....	5	18	7	1	—	—	—	1	—	32
Per cent infected....	11.1	45.0	31.8	6.67	—	—	—	7.15	—	71.1
Cumulative number infected.....	5	23	30	31	31	31	31	32	32	32
Cumulative per cent infected.....	11.1	51.1	66.7	69.0	69.0	69.0	69.0	71.1	71.1	71.1
Kitchen and Diet Kitchen Maids.....										
Total negative.....	66	57	51	42	35	27	22	20	19	66
Number infected....	9	6	9	7	8	5	2	1	1	48
Per cent infected....	13.6	10.5	17.6	16.6	22.8	18.5	9.1	5.0	5.26	72.7
Cumulative number infected.....	9	15	24	31	39	44	46	47	48	48
Cumulative per cent infected.....	13.6	22.7	36.4	47.0	59.0	66.7	69.7	71.2	72.7	72.7
Orderlies and Cleaners										
Total negative.....	31	23	11	10	7	7	5	3	3	31
Number infected....	8	12	1	3	—	2	2	—	—	28
Per cent infected....	25.8	52.2	9.1	30.0	—	28.6	40.0	—	—	90.3
Cumulative number infected.....	8	20	21	24	24	26	28	28	28	28
Cumulative per cent infected.....	25.8	64.5	67.7	77.4	77.4	84.0	90.3	90.3	90.3	90.3
Miscellaneous										
Total negative.....	34	32	29	24	21	21	20	20	20	34
Number infected....	2	3	5	3	—	1	—	—	1	15
Per cent infected....	5.88	9.38	17.2	12.5	—	4.76	—	—	5.0	44.1

TABLE VIII—*Continued*

	3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.	24 mos.	30 mos.	30+ mos.	Total
Cumulative number infected	2	5	10	13	13	14	14	14	15	15
Cumulative per cent infected	5.88	14.7	29.4	38.2	38.2	41.2	41.2	41.2	44.1	44.1
Total										
Total negative	223	180	132	105	89	79	69	63	61	223
Number infected	43	48	27	16	10	10	6	2	2	164
Per cent infected	19.3	26.7	20.4	15.2	11.2	12.7	8.7	3.17	3.28	73.5
Cumulative number infected	43	91	118	134	144	154	160	162	164	164
Cumulative per cent infected	19.3	40.8	52.9	60.0	64.5	69.0	71.7	72.6	73.5	73.5

attempted to correct the time factor among the vaccinated persons, assuming that the cases developing manifest tuberculosis in the additional three months' exposure (which will make the average time for the vaccinated entirely comparable with the non-vaccinated negatives and the positives, that is, 1.44 years) will do so at the same rate obtaining during the actual time exposed, 1.19 years. This calculation, to equalize the time factor, results in the following: among 470 vaccinated persons in the occupational groups mentioned previously, 11 or 2.3 per cent would develop manifest tuberculosis in 1.44 years. Among 274 non-vaccinated negatives in the same occupational groups, 32 or 11.7 per cent developed manifest tuberculosis. Among 462 positives in the same occupational groups, 13 or 2.8 per cent developed manifest tuberculosis. The difference in percentages between the vaccinated and non-vaccinated negative groups (using the calculated figure for the vaccinated group) is 9.4, which is 6.7 times its own probable error. The ratio is 1:5.03.

There was one death from tuberculosis in this Sanatoria study, which occurred in the non-vaccinated negative group.

Experience of Graduate Nurses and Nurses' Assistants Selected from the Sanatoria Study Because they were Subjected to the Strain of More Excessive Infection

Combining the experience of the graduate nurses and nurses' assistants who have much the same type of exposure to the environment, are of the same sex and in the same age-group (25.5 years and 22.7 years, respectively), we find that the period of exposure for the vaccinated and non-vaccinated negatives and positives is 1.075 years, 1.06 years and 1.255 years, respectively (see table VI).

The incidence of infection in the nurses' group was 71.8 per cent after one year's exposure; this is practically the same rate obtaining in the Manitoba Sanatorium and St. Boniface Sanatorium where the incidence of infection for

these groups after one year's exposure was 71.5 per cent and 79.7 per cent, respectively, during the same period.

Findings: Among 203 vaccinated nurses, 5 developed manifest tuberculosis, or 2.46 per cent; among 113 non-vaccinated negative nurses, 18 developed manifest tuberculosis, or 15.9 per cent; among 293 nurses positive to tuberculin, 11 developed manifest tuberculosis, or 3.75 per cent. The difference in percentages between the vaccinated nurses and non-vaccinated negative nurses is 13.44 per cent, which is 5.5 times its own probable error and therefore of statistical significance. The ratio is 1:6.5.

It has been pointed out that vaccination as carried on in this study was instituted after the negative reactor entered the infectious environment and while on duty. The method is practical and can be carried out without inconvenience. It is realized, however, that in environments where the incidence of infection is 1 per cent per month (Saskatchewan Hospital environment) and 5 per cent per month (Saskatchewan Sanatoria environment) some persons become infected before vaccination is effective. This constitutes a slight weighting against the vaccinated group.

It would be of interest to persons studying vaccination in environments of differing infectivity to note that where the infection rate is high, such as a sanatorium environment where the majority get infected within a year, manifest tuberculosis developing among those entering the environment with a negative tuberculin is grouped in the early months of employment (see table IX). Whereas in environments of moderate infectivity such as hospital environment, where only a minority get infected in any one year, and where the nurses are in training for three years, manifest tuberculosis developing among those entering the environment with a negative tuberculin is spread over the greater part of this period (see table X). These tables indicate that the rate of infection and duration of exposure are two very fundamental factors in comparing results secured by vaccination in different environments.

Conclusions

1. BCG vaccination of nurses negative to tuberculin on entrance to a General Hospital environment, where the rate of infection was approximately 12 per cent *per annum* among the non-vaccinated negatives, and the duration of exposure was 2.42 years, reduced the number of cases of manifest tuberculosis that developed among this group to its fourth; the ratio of vaccinated negatives as compared with non-vaccinated negatives is 1:4.27.

2. BCG vaccination of Saskatchewan Sanatoria employees negative to tuberculin on entrance to the sanatorium environment, where the rate of infection among the non-vaccinated negatives was 60 per cent during the first year of exposure, and the duration of exposure was 1.44 years, reduced the number of cases of manifest tuberculosis that developed among this group to its fifth; the ratio of vaccinated negatives as compared with non-vaccinated negatives is 1:5.03.

3. These findings are of statistical significance.

TABLE IX

TIME AFTER ENTRANCE INTO SANATORIUM ENVIRONMENT THAT MANIFEST TUBERCULOSIS APPEARED
Saskatchewan Sanatoria Group
Entered Environment Period 1934-43

Time in Months	1	2	3	5	6	8	9	11	12	13	14	16	17	19	20	28	31	33	37	40	42	48	56	80	91	Total
BCG Vaccinated Employees	—	—	2	—	1	—	1	—	1	1	—	2	—	—	—	—	—	—	—	—	1	—	—	—	—	9
Negative to tuberculin on entrance employees, non-vaccinated	1	—	—	2	4	3	2	3	3	1	1	3	2	1	1	1	1	1	1	—	1	—	—	—	—	32
Positive tuberculin employees on entrance	—	2	—	—	2	—	—	1	—	—	—	1	1	—	—	—	—	—	—	1	—	1	1	2	1	13
Total	1	2	2	2	7	3	3	4	4	2	1	6	3	1	1	1	1	1	1	1	2	1	1	2	1	54

TABLE X

TIME AFTER ENTRANCE INTO HOSPITAL ENVIRONMENT THAT MANIFEST TUBERCULOSIS APPEARED
Eight Saskatchewan Hospitals and the Winnipeg General Hospital Combined
Nurses Entering Training
Period 1934-43

Time in Months	4	5	6	7	9	10	12	13	14	15	16	17	19	22	24	25	26	27	29	30	31	32	33	34	36	37
BCG Vaccinated	—	—	—	—	—	1	—	1	—	—	—	—	1	—	1	—	1	—	1	—	—	—	—	2	—	—
Negative to Tuberculin on Entrance	1	2	1	1	2	2	6	1	1	3	2	1	2	1	1	—	1	1	—	5	3	3	1	—	1	2
Positive Tuberculin on Entrance	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—
Total	1	2	1	1	2	3	6	2	1	3	2	1	3	1	2	1	2	1	1	5	3	3	1	2	2	2

Time in Months (*cont'd*)	39	41	42	44	48	49	51	57	59	60	68	88	Total
BCG Vaccinated	1	—	—	—	—	—	—	—	—	—	—	—	9
Negative to Tuberculin on Entrance	1	1	1	1	2	—	2	—	—	1	1	1	55
Positive on Entrance	—	—	—	—	—	1	—	1	1	—	—	—	5
Total	2	1	1	1	2	1	2	1	1	1	1	1	69

4. BCG is not a 100 per cent effective prophylactic; its protection is very considerable, but by no means absolute.

5. BCG vaccination was found to be safe.

6. Regarding the severity of manifest tuberculosis developed among the vaccinated as compared with the non-vaccinated negatives, it was found that in the vaccinated group the lesions were less extensive.

7. The serious situation that had been developing with regard to excessive incidence of tuberculosis among nurses and sanatoria employees who did not react to tuberculin on entering the environment, during the period 1930 to 1938, has not been present since vaccination of negative reactors was begun in September, 1938. The nursing schools and the League in Saskatchewan no longer have anxiety and worry with regard to excessive tuberculosis developing among their negatively reacting staff.

Discussion

Dr. Joseph D. Aronson, Philadelphia, Pennsylvania: Dr. Ferguson's studies under controlled conditions show a definite decrease in the incidence of tuberculosis among nurses and attendants of sanatoria who have been vaccinated with BCG vaccine. We should like, at this time, to present corroborative evidence as a result of a controlled study to determine the value of BCG among Indians in the United States and Alaska. This study had its inception in 1935 as a coöperative investigation by the Office of Indian Affairs and the Henry Phipps Institute of the University of Pennsylvania, and, more recently, the Tuberculosis Control Division, U. S. Public Health Service, and the National Tuberculosis Association.

From February, 1936 to February, 1938, 1,550 persons, ranging in age from less than one year to 19 years, were vaccinated intracutaneously with either 0.1 or 0.15 mg. of freshly prepared BCG vaccine. During this same period 1,557 persons of the same age and sex, living in the same areas and under the same conditions, received 0.1 cc. of sterile physiological salt solution and served as controls.

All persons included in this study failed to react initially to 0.00,002 and 0.005 mg. of PPD tuberculin, and, with few exceptions, the chests of the two groups were X-rayed either before or shortly after they were included in this study. Tuberculin tests and X-ray films were made annually of both groups. The tuberculin tests were given and interpreted by the same person, while the X-ray films were originally read by a member of the study group, without his knowing whether the film was from a vaccinated or control case. Subsequently all films were reviewed by a roentgenologist of the Tuberculosis Control Division of the U. S. Public Health Service, who had no connection with the original study, and who did not know whether the films represented a vaccinated or control case and did not know the results of the tuberculin test.

A history of exposure to tuberculosis was found in 21.4 per cent of the vaccinated, and in 19.8 per cent of the controls. During the first five years of this study approximately 90 per cent of both groups were reëxamined annually,

while during the sixth year, due to the war, only 75 per cent were reëxamined. Among the controls, a total of 60 deaths from all causes has occurred during the six years of observation, as compared with 34 deaths in the BCG vaccinated group. Of the 60 deaths among the controls, 28 were due to tuberculosis, while among the BCG group only 4 of the 34 deaths were due to this disease. The total number of cases of tuberculosis, including deaths from this disease, was 40 in the BCG group and 185 among the controls. Of special significance is the life table experience of the two groups during the six years of observation. Thus the attack rate per thousand person-years of exposure for the BCG cases was 11.8, 6, 2, 4.1, 2.2 and 0.8, respectively, while for the control group it was 26.1, 23.3, 23.3, 26.1, 21.9 and 25, respectively. Of interest is the high incidence of tuberculosis during the first two years following vaccination, after which the rates per thousand years of exposure declined rapidly. On the other hand, among the control group the rates during the six years of observation remained approximately the same. The 4 deaths among the BCG vaccinated group occurred within the first 2 years following vaccination. Among the control group deaths from tuberculosis have occurred in all of the years of the study.

Our results indicate objectively that BCG vaccination is associated with definite protection against the development of tuberculosis, as measured by the mortality and morbidity experience of the two groups included in this study. The results of this study lend support to the use of the BCG vaccine as a protective measure for tuberculin-negative persons who, because of their duties or social or economic conditions, may be exposed to tuberculosis.

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Special mention should be made of the work done by Miss Jeannette Broderick, Mr. K. B. Gillie and Mr. Frank Froh who enthusiastically pursued the tedious statistical and clerical work connected with this study.

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NEW FRONTIERS IN HEALTH EDUCATION

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"KNOW your opportunity" is a phrase inscribed on the temple of Apollo at Delphi. "To improve the golden moment of opportunity, and catch the good that is within our reach, is the great art of life." (1) To-day's opportunities are great for the advancement of health education and for effective international co-operation in public health.

A new peak of public interest in health affairs has been reached. New scientific knowledge has sharpened imagination and quickened progress. The health of a man's neighbors is of increasing concern, as observed by J. B. S. Haldane, who points out that during the war it was again emphasized that our fight against micro-organisms "extends beyond the boundaries of nationality, race, or even species. Every Rumanian infected with infantile paralysis," said Haldane, "every Indian with smallpox, every rat with plague, diminishes the probable length of my life." Experiences during the war, and studies by Gunn and Platt of voluntary health agencies in the United States, both illustrate in different ways the significance of joint planning and co-operative action for the attainment of a common goal.

Is there a need for health education? Are we so wise that we have beaten our parasites? Geddes Smith (2) answers both questions: "Sallow-faced farmers shivering and burning with malaria, bedside watchers listening to the anxious breathing of pneumonia, jaded nurses tending the wrecks of syphilis, millions exasperated by the nagging misery of the common cold know the answer."

Health education is the application of measures to induce experiences which favorably influence knowledge, attitudes and actions for the prevention of disease and the perfection of health of the individual members of society. The function of community health education is broader than the term implies, and includes assistance in community organization and professional public relations. This application must be intelligent, consistent, and persistent in the home, the school, and the community. Effective operation depends upon the provision of personnel qualified to study needs, appraise resources, and develop a constructive plan of action. An understanding of the people's needs, interests, customs, language, and tradition is fundamental, as is the use of simple words and practical methods. Enlightened public opinion and participation will accomplish a dual purpose:

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1. Application of health knowledge by the individual for improvement of health practices and attitudes.
2. Acceptance of responsibility by citizens who become aware of the needs and services through their experiences and then support the development of adequate health programs.

While everyone needs education, several groups deserve emphasis:

1. Professional workers, to keep abreast of new discoveries and techniques, e.g. members of "the public health team"; physicians, dentists, nurses, and social workers and the students; teachers in school, college, and university.
2. "The infant, the child, and the adolescent themselves, who are not only in a pliable phase of life but as yet are unembarrassed (or less embarrassed than their elders) by prejudice or the pressure and conflict of affairs."
3. "The adult, and especially the parent and prospective parent, who are generally anxious to do well by their offspring, and among whom a growing desire for enlightenment in the matter of health is already manifest."
4. "The employers of labour, since they control the conditions of a large part of the lives of our huge industrial communities."
5. "The elected representatives of the people, whether in central or local government, for these hold the responsibility for policies and legislation directly or indirectly affecting the health of large or small, urban and of rural populations." (4)

Upon seeing a rainbow for the first time, a child exclaimed, "Oh, mother, what is it advertising?" Does this question reflect an atmosphere of commercial or utilitarian interest which may overshadow intrinsic values of community enterprises essential for freedom and fullness of living? Competition for public attention demands that health education be positive and dynamic and of sound content.

Though the official health agency should lead in the planning and development of a program, health education cannot and should not be the exclusive function of any one agency; only by the co-operation of all related official and voluntary professional agencies can a community program reach its greatest effectiveness. This activity is the concern and responsibility of all members of the staffs of all the health organizations in the community, each contributing wherever it can through its personal contacts and services, visualizing the individual as a whole, the family as a whole, and the community as a whole. Furthermore, as Frank has well emphasized, basic assumptions as to procedure need clarification, with an "endeavor to formulate some kind of social philosophy and concerted plans of operation that will more effectively translate new knowledge into living habits and will guide our whole social order in the interest of health care and human conservation." (3)

In the changing order of world affairs, some realignment of services and of educational methods may be required in order to give proper emphasis to major needs. But this realignment must take place gradually with due regard

for current needs and opportunities. For example, in sanitation, there is much to be done to safeguard milk and food supplies, to improve housing and to protect the industrial worker. In reporting an outbreak of food poisoning recently, Doyle pointed out that preventive measures include the education of food handlers in the understanding of the chain of events leading to the successful growth of staphylococcus in foods, and supervision by the sanitary officers to insure that the proper hygienic technique is being used in restaurants and that refrigeration is adequate and being intelligently applied (5). In the same issue of the Canadian Journal of Public Health is the announcement of the establishment of schools for food handlers by the Department of Public Health of Saskatchewan. A school for both the pre-service and the in-service training of food handlers, including many veterans, was also recently organized in New Haven with the co-operation of the Department of Health and with the support of the Restaurant Association. This is an outgrowth of interest stimulated by the sanitary inspectors in a gradual change of emphasis from police methods to educational processes.

The health administrator and his associates will continue their interest in syphilis and tuberculosis, including mass X-ray for all hospital admissions and selected groups, and devote more attention to heart disease and cancer. Better methods are needed for health instruction concerning these diseases. The guidance of the individual to meet the changes in living as he grows older will soon become one of our major problems, according to Frank, because of the rapid growth of the population over fifty, among whom there is so much chronic illness, disability, and impairment, and psychosomatic disorders. "Organizations for medical and health care should become the major agencies for health education, just as the family doctor in previous generations advised and cared for individuals from childhood on."

Recognizing that the specialist in health education must not only possess personal characteristics of leadership, but also be well versed in the principles and practices of both education and public health, we have modified our training program at Yale. Time devoted to lectures has been reduced to a minimum, being chiefly for distinguished guests and for presentation of new material not readily available in publications. Short didactic courses are being combined for more seminar and project work, for more time for reading and discussion, and for increased student participation, program appraisal and planning. One seminar of the Department of Education and the Department of Public Health deals with the mental, moral, and physical growth of children. The seminar membership is composed of both graduate students and faculty of the departments immediately concerned and of representatives of the School of Medicine, Nursing and Religion. Guest speakers from related fields of administration, economics, psychology, or sociology are occasionally invited to participate, for the discussion frequently leads to a consideration of many basic issues of modern society relating to the conservation of human resources. Such a mechanism provides an opportunity for members of a group to understand each other's language, to consider many problems of mutual interest, to exchange viewpoints, to stimulate group thinking, and to plan for organized co-operation which may be more significant than unified administration. We have been concerned in the United

States, for example, over the situation which caused the rejection as unfit for general military service of more than one in every four 18-year-old boys under the Selective Service System. But perhaps this is not surprising when we consider the number of defects found in children at school examinations, year after year, without adequate steps being taken to correct this situation. So-called health examinations alone will not remove the adverse conditions or their causes. A more comprehensive plan is required, with a broader understanding of the many educational, medical, psychological, and social factors, coupled with teamwork among the various groups responsible for results.

All students who are majoring in health education receive instruction in the administration and social aspects of medical care, in view of the important role which they are likely to play in community organization and in education. The reasons for provision of such orientation are as follows:

1. Intensive health education serves to increase the demand for more and better medical care and to influence the pattern of medical and dental practice (e.g. more calls for minor ailments, preventive services, check-ups). As a corollary, intensive health education ultimately may decrease the need for the care of serious conditions.

2. The specialist in health education can make an important contribution to the development of medical care by interpreting the need for action as well as plans designed to meet the needs of the people, and by helping to build sound community health organization.

3. The specialist in health education has an important function to perform in the operation of medical-care programs by instructing the people not only in personal health but in the intelligent and discriminating use of available resources.

4. To perform these functions, the specialist in health education must become acquainted with the basic principles of organization of medical care and with current events in this field, and have an appreciation of relationships with the medical, dental and other professional personnel concerned. An increasing opportunity is being recognized for the education of both patients and personnel in clinics and hospitals, and in health centres. This involves more than the casual display of posters or distribution of printed matter. Administrators may stimulate the instruction of mothers before they return home with their babies, as well as of both expectant fathers and mothers in group sessions during the prenatal period. Education in first aid, instruction of nurses' aides, and supervision given to volunteers should have more than immediate benefits for public information and understanding. The clinic offers an excellent opportunity for general health education through visual methods and literature, and for special instruction regarding nutrition, personal hygiene, and immunization against disease. But methods have to be geared to the interests of the clients, e.g. different for cancer than for syphilis. We have only begun to train workers for this task. Encouragement may be given to medical students and house physicians to take epidemiological as well as purely clinical histories, and to consider the social backgrounds of

their patients in relation to other problems. The epidemiologist and the medical social worker both have important roles in the training of medical students and of public health graduate students, working jointly with other members of the public health staff.

More and more concern is indicated for nutrition in its subtle and complex influences upon vigor and efficiency and satisfaction. Consequently, our graduate students receive basic instruction in nutrition as well as in educational techniques. The absence of vitamins or iodine or fluorine in the diet of a community may seem as important as the presence of pathogenic organisms in its milk supply. In Canada you have made great strides and shown ingenuity in the education of the public concerning nutrition. Of importance is your report from the University of Toronto on a study of nutritional conditions in a group of urban children. Leeson and associates (6) suggest that the principal factor contributing to the occurrence of poor nutrition among the children examined did not appear to be economic in view of the amount spent for non-essential foods, but was a lack of information regarding nutrition and a failure on the part of some householders to manage their children and to take advantage of the nutritional information supplied. According to Frank, eating may become affected with a variety of feelings and serve as a form of parent-child conflicts, as shown by the many feeding problems among school children, and the food aversions among adolescents. "What should be a normal physiological process of eating and enjoying food thus may be loaded with all manner of emotional conflicts and moral issues. Later on, these persistent feelings about eating and the traditional food habits the child has learned in the family may operate to defeat the health and nutritional programs designed to foster better nutrition."

We can be proud of the record of achievements in public health and of great triumphs in preventive medicine during the war years. But we are in no position to be complacent or to rest on our laurels until better health for mothers and children is assured, the causes of cancer are discovered, and the tragedies of home, industrial and traffic accidents are prevented, to give only a few illustrations. Looking forward as observed by Dr. Vivian and Dr. Ryle, we should base our new campaigns and changing discipline on a closer alliance than heretofore between the medical and social sciences and educational endeavor.

Field training is an essential element in the graduate university preparation recommended by the Committee on Professional Education of the American Public Health Association. Furthermore, in a community program, provision should be made for in-service training of various individuals and groups in accordance with the educational policies of the organizations involved. For years, in-service training of teachers and of nurses has been regarded as important. Aid may likewise be given to colleges in the planning of the pre-service training program for professional personnel.

The spoken word is doubtless the most effective instrument in health education. This has been demonstrated by public health nurses. For mass education, a primary function is to organize and assist in conducting a speakers' bureau, conferences, meetings, and radio programs. The physicians who com-

prise the membership of at least one County Medical Society Speakers' Bureau receive special training in public speaking. In accepting the responsibility for the preparation, selection, assembly and distribution of health education materials, the skilful health educator uses the services of special technicians and health experts (including physicians and dentists) as necessary. Such materials include: reports and other printed materials; visual aids, such as motion pictures, photographs, graphic materials, exhibits and posters and news releases.

Another function is to organize and operate an informational service to provide source materials and source references in answer to requests. Consultation and guidance service must be given to various individuals and groups desiring such service in developing and improving their health education activities. An experienced health educator may contribute to the improvement of the quality of health education of the school child in accordance with the standards and policies of the school system, through aid in program or curriculum planning and through teacher and supervisory conferences and such other activities as the school may desire. A feature of the program may be to assist in organizing, promoting, and guiding study programs in the field of health for adult and group work agencies.

Finally, it is not only necessary to study needs and resources at the outset to determine the nature of the program to be developed, but it is equally essential to check results. This involves assistance in the continuing appraisal of health-education methods and materials, and evaluation periodically of the effectiveness of health-education procedures. To facilitate co-operative planning and united action, a community health-education committee or council is helpful. The goals of health education are many and diverse. The task is difficult, but one of variety and of vital importance to society. Those who are engaged in this important enterprise must work and play together, and come to know and understand and have faith in each other and in their jobs and their common goals. "The mutual dependence of man is so great in all societies that scarce any human action is entirely complete in itself, or is performed without some reference to the action of others."(7)

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AN INDUSTRIAL HYGIENE PROGRAM IN AN AGRICULTURAL PROVINCE

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UNLIKE the industrial Provinces of the East, the development of a Bureau of Industrial Hygiene in Manitoba is of comparatively recent date. Full-time personnel were not employed, in fact, until after the beginning of World War II. At that time financial assistance from the Rockefeller Foundation and the loan of a chemist with special industrial-hygiene training from the Department of National Health and Welfare became available.

Prior to that time the Department of Health and Public Welfare had in 1937 entered into agreement with the Workmen's Compensation Board to examine all workmen employed in certain industries where silicosis might be contracted. The first silicosis survey of the hard-rock miners of the Province was made that year (1937). Each year since then the miners have been visited by a Department physician, an X-ray unit, and a technician. By means of these surveys every miner working in the Province is checked annually and if his condition is satisfactory he is given a Subsisting Licence or Certificate. This program was planned chiefly from the one already in operation in the Province of Ontario. Up to the end of 1945 over 13,000 physical and X-ray examinations had been made of miners.

During 1942 the first full-time Medical Director was appointed. Due in large measure to the war, this post has been held by three persons since that time. With this appointment Industrial Hygiene became a fully organized Bureau in the Department of Health and was able to set about developing its own program. During the war a considerable portion of the work done was with the Services, particularly the R.C.A.F., and with wartime industry. At that time control equipment such as exhaust ventilation, etc., was practically non-obtainable. This and the pressure of wartime production made a considerable degree of compromise necessary. This situation is, in fact, only now beginning to improve.

From the outset the Industrial Hygiene Bureau was one of three which together constitute the Environmental Health Section of the Department. The two other Bureaus are Public Health Engineering and Food and Milk Control. Experience is proving that this is for us a satisfactory arrangement. By co-operating and sharing personnel with each other, these three Bureaus have been

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able to broaden the scope of their work economically and have been able to take an effective and legitimate interest in man's whole environment. The Public Health Engineer, for example, applies the major portion of his time to Public Health Engineering. He is, however, available to Industrial Hygiene in formal plant surveys, in matters related to sanitation, ventilation, lighting, etc. In the same way the Industrial Hygiene Chemist and his assistant, besides carrying their share of the Industrial Hygiene program, can assist Public Health Engineering with water analyses, water treatment, B.O.D. estimations, and the like. The Industrial Hygiene Physician in like manner besides his own specific work can contribute administrative knowledge to assist the other Bureaus in the decentralization of their programs to the rural health units, etc.

To the purist this type of program may represent heresy—on the other hand, there are practical merits to be derived from it. Once a measure of co-ordination has been achieved between bureaus, programs can be planned in advance. Elective projects of considerable dimension in engineering or industrial hygiene can be taken on, and though they may absorb most of the staff at any one time this is done without impairing the even flow of routine work in all bureaus.

There is no need to weary you further with descriptions of our compromise philosophy of industrial hygiene. It is recorded only as a partial and practical solution to the problem of making industrial hygiene knowledge and practice available in a Province where the major public health challenge is from a rural farming population, where industry, barring the mines, is almost wholly located in one centre, Winnipeg, and is limited in its variety and scope.

The foregoing remarks should not, however, be interpreted as indicating that pure industrial hygiene is not practised in Manitoba—it most assuredly is. The actual work of the Bureau is developed around a very well equipped and well staffed laboratory quite capable of conducting all the general run of industrial hygiene estimations and investigations. During 1944 the silicosis survey heretofore available only to mines was extended to the foundries of the Province. The 100 M.A. portable X-ray equipment was set up in each plant having over 50 foundry workers and in a central location for smaller plants. About 1,000 foundrymen received complete physical examinations and chest X-rays. At the same time complete plant surveys were made at each of the foundries and a series of recommendations based upon the findings were developed for each company. Wartime production quotas and the scarcity of control equipment have handicapped action by foundry owners to fall in line with some of these recommendations. In most instances, however, management have been pleased with the survey results and have co-operated very well. The third annual foundry survey was completed a few weeks ago.

The laboratory also provides a stipple cell counting service to all employees known to be exposed to a lead hazard. About 100 counts are being made each week at the present time. This service too has been enthusiastically accepted by management and employees.

About one-third of the work of the Bureau is self-initiated; the rest comes in as requests from the Department of Labour, the Workmen's

Compensation Board, the City of Winnipeg Health Department, and from industry itself. The process of making our services known to other agencies and individual companies we have found is painfully slow. In this regard we are handicapped by the lack of good printed material; particularly is this true in our appeals to small industry. Some literature has been developed locally, but each project, to be effective, requires a very considerable amount of time. So far as posters are concerned, we have relied almost wholly upon American sources. The limited publications of the Health League of Canada and of the Federal Health Department are insufficient. We will welcome the day when good-calibre Canadian industrial health leaflets and posters become available. Could this not be a function of the Federal Industrial Hygiene Division? Working with the National Film Board, their production facilities should be unexcelled.

Efforts directed towards encouraging small industries to undertake health programs with part-time medical and nursing service or to improve services now in operation have met with only limited success. Medical men are still incredibly busy and, though willing to take on industrial work as part of their office practice, are rarely interested in spending the time necessary to demonstrate the practicality of part-time medical service to small industry. Most will agree there is considerably more to industrial hygiene than the pre-employment examination of employees in a city office miles removed from the place of work. Management, too, is difficult to convince in this regard. Certainly it seems that unless management has a progressive or enlightened attitude towards this problem, a compromise "pot boiler" type of service is almost inevitable. We feel that one of our prime responsibilities is to educate and sensitize management regarding the modern thinking and practice of small industry medical service.

As to jurisdiction, the Bureau has no specific legislation and operates within the Regulations of the Public Health Act or the Factories Act. The latter Act, administered by the Provincial Department of Labor, has among its provisions the following, "It shall not be lawful to keep a factory so that the safety of any person employed therein is endangered or so that the health of any person employed therein is likely to be permanently injured." Factory inspectors administer the safety and sanitation aspects of this Act. The Bureau of Industrial Hygiene is frequently called upon to give an opinion regarding health hazards. In this way the Bureau acts for the most part as an advisory rather than a law-enforcing agency. Further, in the advisory capacity the Bureau maintains a thorough abstract file covering all the important industrial periodicals and the various pamphlets issued by other agencies. This service is, we find, particularly valuable in a relatively small Bureau where the program must be generalized.

STUDIES OF THE SEROLOGY OF TYPHUS FEVER

M. ELIZABETH MALCOMSON[1] and FRANKLYN O. WISHART[2]

III. *Weil-Felix Test and Complement Fixation with Proteus OX19 Following Typhus Fever Infection and Vaccination*

AT the time of the commencement of these studies, only the Weil-Felix test was universally recognized as a diagnostic aid in the rickettsial diseases. Accordingly, it was employed in the first stages of the investigations of the serology of typhus fever. As tests using rickettsial antigens became available, the Weil-Felix test was continued in order to make certain comparisons between it and the newer tests. Reference has been made in previous communications to the antigenic relationship between Proteus OX19 and *Rickettsia prowazeki* (18), and to results of complement-fixation studies with sera from cases of typhus fever and from vaccinated individuals (10). Certain observations recorded here may serve to indicate something of the status of the Weil-Felix reaction in the rapidly developing picture of the serology of rickettsial diseases. Some limited complement-fixation experiments with Proteus OX19 were also conducted.

Agglutination Technique

A search of the literature revealed no uniform procedure for the performance of the Weil-Felix reaction (6), (9), (16), (2), (3), (12). Since the preparation of antigen varied, as did the time and temperature of incubation, preliminary experiments were conducted to determine the technique which was to be used and the following procedure was adopted.

Antigen

The non-motile form of Proteus OX19 was used. The stock culture was kept on egg slopes and was transplanted every three months. The culture in use was checked for motility at least once a week. Living suspension of OX19 (washed off agar slopes with 0.85 per cent buffered saline) was used as it proved to be more sensitive than heat-prepared, formolized or alcoholized preparations. The suspension was used at a density equal to that of the McFarland # 2 standard (17).

Method of Performing the Test

Two-fold serial dilutions of serum (0.25 cc.) were placed by pipette into pyrex agglutination tubes (75 × 8 mm.) and to each tube was added 0.25 cc.

Contribution from the Connaught Medical Research Laboratories and School of Hygiene (Department of Hygiene and Preventive Medicine), University of Toronto, Toronto, Ontario, with financial assistance from the National Research Council of Canada.

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of antigen dilution. After the contents of the tubes were mixed, the racks were incubated in a water-bath at 37°C. for 2 hours and the tests were read after standing overnight at 4°C. The titres recorded were final dilutions and the end point was read when agglutination was just visible with the naked eye. Positive and negative sera were included with each day's tests, as well as a saline control for antigen stability.

Experiment I—Response to Vaccination

(*a*) Serum samples were obtained from individuals before and four weeks after a course of typhus vaccine inoculations. Three small groups, each receiving a different vaccine preparation, were studied as shown in Table I.

TABLE I

RESPONSE OF HUMANS TO VACCINATION

Vaccine	Number of Individuals	Dose (cc.) 7-day Interval	Increase in Titre				Percentage Showing Increase
			Two-fold	Four-fold	Eight-fold	Sixteen-fold	
A	17	1, 1, 1	28%	6%	18%	6%	58
B	19	¼, ½, 1	37%	16%	21%	0	74
C	13	¼, ½, 1	0	15%	39%	0	54

In contrast to the consistent occurrence of antibody, usually to a high level, reported in cases of the disease, only 50 to 75 per cent of these individuals showed an increase in the Weil-Felix level over that found prior to vaccination, and when an increase was observed, it was usually not marked.

(*b*) Two groups of persons received 3 increasing doses of ¼, ½ and 1 cc. of the same lot of vaccine; in one group with a 3-week and in the other a 1-week interval between doses. Serum samples were obtained before and 4 weeks after completion of inoculations. The results of this experiment are shown in Table II.

TABLE II

EFFECT OF INTERVAL BETWEEN DOSES ON WEIL-FELIX RESPONSE

Interval	Number	Increase in Titre			Percentage Showing Increase
		Two-fold	Four-fold	Eight-fold	
3 Week	13	45%	19%	0	64%
1 Week	14	14%	36%	0	50%

These findings are consistent with those of (*a*) in that only about half of the individuals tested showed an increase in Weil-Felix titre and the increases were of a relatively low order. A slightly greater number responded where the longer interval between doses was used but the degree of response was somewhat less. In view of the small groups studied it cannot be said that any appreciable difference was demonstrated.

Experiment II—Response to Infection

(*a*) Only single samples of sera from typhus cases were available to us and the information obtainable was therefore limited. Weil-Felix tests were carried out on 48 such sera and the results are briefly summarized in Table III.

TABLE III

SUMMARY OF WEIL-FELIX TITRES OF INFECTED HUMANS

Titre for Proteus OX19		<1:100	1:100	1:200	1:400	1:800	1:1600	1:3200 and>	TOTAL
Individuals Tested	Number	0	2	3	4	12	9	18*	48
	Percent	0	4	6	8	25	19	38*	100

*End point not reached in 13 cases (27 per cent)

In all cases a titre of 1:100 was observed, while 90 per cent were at least 1:400 and 38 per cent 1:3200 or greater. It was not possible to correlate the titres with day of disease or severity of illness.

(*b*) *Response to Infection in Previously Vaccinated Persons*

In a previous paper (10) the results were presented of complement-fixation tests with the sera of 22 vaccinated individuals who subsequently developed typhus infections. It was noted, in general, that the production of type-specific antibody was striking while common antibody increased little, if at all. Weil-Felix tests were carried out on 14 of these sera and in approximately 50 per cent no increase in titre was observed, and in the remainder the increase was not marked.

Experiment III—Complement Fixation with Proteus OX19

In investigations of the antigenic structure of the rickettsiae and their relationship to Proteus OX19, suspensions of the latter organism were used successfully as complement-fixing antigens with typhus sera (18). Since such fixation has been a controversial matter, the opportunity was taken to examine a series of typhus sera in a comparative study with the Weil-Felix reaction. The technique employed was the same as that reported previously. The Proteus OX19 culture was grown on agar slopes, washed off with saline containing 0.1 per cent formalin, and titrated for optimal dilution against convalescent typhus serum.

The complement-fixation and Weil-Felix titres of the sera tested are shown in Table IV.

DISCUSSION

From the study of sera from vaccinated persons it was apparent that a response to vaccination was not consistently demonstrable by the Weil-Felix test. It might be held that the apparently poor response was due to the inadequacy of the early vaccines used. That this was not the whole explanation was shown by complement-fixation tests with rickettsial antigens in which it was observed that a great majority of the individuals had responded to vaccine by the production of type-specific antibody (10). However, little common antibody had been formed, and as it is in the common rickettsial antigen that

the fraction shared with Proteus OX19 is found (18), this offers an explanation for the low Weil-Felix levels. Results essentially similar to ours were obtained by Felix (7) and by Penfold (11) in the study of persons given Connaught Medical Research Laboratories vaccine. Felix (8) reported a further study of the Weil-Felix reaction following vaccination and noted an increase in Weil-

TABLE IV

Case	Complement Fixation OX19	Agglutination OX19
1	3200*	3200*
2	400	800
3	200	200
4	200	800
5	200	400
6	1600	6400
7	3200	6400
8	100	400
9	200	200
10	400	1600
11	1600	1600
12	3200*	51200
13	1600	800
14	1600	3200*
15	800	3200
16	400	1600
17	1600	3200*
18	800	800
19	1600	3200*
20	800	1600
21	3200	3200*
22	800	3200
23	1600	3200*
24	1600	100
25	400	800
26	800	800
27	3200	3200
28	1600	1600
29	3200	3200
30	400	200
31	1600	800
32	400	1600
33	400	800
34	400	3200
35	3200*	1600
36	800	800
37	1600	1600

*Not titred out.

Felix level in 50 per cent of persons. In tests carried out before and after both primary and booster doses of vaccine, Topping and co-workers (14) observed no significant rise in the agglutinins for the OX19 strain of Proteus.

In the sera from 48 typhus cases examined by us the titres were sufficiently high in the great majority to leave no doubt as to the diagnosis. In a small percentage it would have been desirable to demonstrate an increase in titre with the course of the disease as "normal" individuals may be positive at

low to moderate levels. In this regard, Felix (8) has described two types of agglutinin curves which may follow the disease; the high type of curve, shown by moderately severe and by some mild cases, reaches a significant level about the 4th to 5th day and usually falls off slowly over a period of months, while the low type of curve appears on the 6th to 7th days, reaches a maximum of about 1:500 and declines immediately after recovery. This type of curve is found following most of the severe cases and most of the very mild infections.

The absence or feeble character of the Weil-Felix response in typhus infections in the previously vaccinated is interesting. A similar observation was made by Topping, (15) and Segal and Zasosova (13) have reported like findings in repeat attacks of typhus fever. Such a result could have been predicted in view of the poor response of common antibody noted in complement-fixation tests. This finding is of definite importance in view of the great number of persons in the armed forces who have received vaccine. Typhus infection in such persons might be missed if reliance were placed on the Weil-Felix test, whereas the complement-fixation reaction employing type-specific antigens is a sensitive indicator of typhus.

In general, it is safe to say that the Weil-Felix reaction no longer holds the pre-eminent position that it did in typhus serology. It is unsatisfactory for measurement of antibody response to typhus vaccine and to typhus infection in the previously vaccinated. Bengston (1) points out that it is unsuitable, because of its transient nature, for epidemiological investigations in human or animal populations. For the diagnosis of unmodified cases of typhus the Weil-Felix test has one definite advantage, but also, some limitations. A rise in Weil-Felix titre occurs earlier than any other serological change. In certain circumstances, therefore, it may be of advantage in providing a quick and early indication of the nature of the disease. However, the occurrence of Weil-Felix antibodies in some "normal" individuals makes interpretation difficult where the titres are low. In contrast to this, the specificity of the rickettsial complement-fixation test is striking. The latter test, employing specific antigens, will distinguish between epidemic and murine infection which the Weil-Felix test does not do. Indeed, it may be positive in Rocky Mountain spotted fever. In reviewing the position of the test, Bengston (1) concludes that the Weil-Felix and complement-fixation tests should be used to supplement each other.

The results of complement-fixation tests with Proteus OX19 in typhus sera are presented chiefly as a matter of interest in view of the negative results observed with this test by Castaneda (4) and Castaneda and Silva (5). Positive results were reported by some of the earlier workers and negative results by others. Failure to obtain positive tests may have been due to details of technique or to variations in the proteus strains used as antigens. Practical use of this test is unlikely, though it is possible that the more accurately standardized antigen employed would give more consistent results than the Weil-Felix test.

Summary and Conclusions

The Weil-Felix test is of little value in measuring antibody response to typhus vaccine in humans. It is positive in approximately only 50 to 75 per

cent of vaccinated persons, and in these the titres are usually low. An explanation of this may be found in the results of the complement-fixation tests which demonstrated poor development of antibody measured by the heat-stable antigen which contains the fraction shared with Proteus OX19.

In cases of typhus fever the Weil-Felix test is usually strongly positive. However, low titres may occur which render interpretation difficult and necessitate the examination of more than one serum sample.

Weil-Felix titres in vaccinated individuals suffering typhus infections are usually not increased or increased only slightly over the levels found in samples taken prior to illness. The test is, therefore, not a reliable diagnostic aid in these circumstances. This fact is of practical importance in view of the extensive use of typhus vaccine during the war period.

Complement fixation with Proteus OX19 is positive in the sera of typhus patients and is closely comparable in sensitivity to the Weil-Felix test. It is also comparable to the latter test in that it is negative, or positive to low titres only, in the sera of vaccinated persons or of typhus cases modified by vaccination.

In these 37 sera the complement-fixation reaction was consistently positive and the titres were essentially similar to those of the Weil-Felix test. No significant difference in the sensitivity of the two tests is apparent.

Similar tests were carried out on a few sera from other sources. In tests of vaccinated persons the increase in Proteus OX19 complement-fixing antibodies was small or negligible. The same was true for typhus infection in previously vaccinated persons. The titre for 2 rabbits infected with typhus was 1:400 and for vaccinated rabbits 1:50 to 1:400.

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Canadian Journal of Public Health

THE PRESENT STATUS OF VACCINATION AGAINST INFLUENZA

THE pandemic of influenza in 1918-19 afforded the opportunity for an intensive investigation of the causative agent of the disease. Studies of the outbreak in the United States in the early fall of 1918 seemed to confirm the opinion that the causative agent was the influenza bacillus, described by Pfeiffer after the pandemic of 1890. As the outbreak continued, a variety of organisms was reported and the influenza bacillus was no longer considered to be the primary cause; it was suggested that the aetiological agent was a virus. However, it was not until 1933 that Smith, Andrewes and Laidlaw, in England, demonstrated the presence of a virus by using ferrets, which animals proved to be susceptible to the disease. Later the disease was transmitted to mice. Subsequently it was shown that there are a number of viruses capable of producing the clinical picture of influenza. Two viruses, influenza A and influenza B, have been frequently isolated and used in preparing vaccines. However, it is known that these two viruses are found in only a part of the total number of cases of influenza. In many instances, attempts to obtain a virus have failed and studies of blood serum from such patients indicate that the patients did not suffer an infection with either A or B virus. There are, probably, many cases of unknown aetiology which, clinically, are considered to be influenza. Although viruses A and B have been the most frequently isolated and, it is presumed, are the most important strains, the prevention of influenza by vaccination, using only these strains, can be only partially effective.

The first vaccines which were prepared consisted of suspensions of virus obtained from the lungs of infected mice, but shortly afterwards chick-embryo tissue cultures were employed. In 1940, vaccine was prepared on a very large scale by the International Health Division of the Rockefeller Foundation, the greater part being forwarded to Great Britain as a gift for use among the civilian population to help to meet an outbreak of influenza which seemed imminent.

In the preparation of this vaccine, fertile eggs were inoculated with the strain of virus now designated virus "A". After incubation of the eggs, the embryos were minced and emulsions of the tissues used as vaccine. To kill the virus, a suitable amount of formalin was added to the emulsions. Controlled observations were attempted in the United States, and from the limited findings it was evident that the vaccine was not significantly effective in establishing protection. Shortly afterwards, it was found by other investigators that the allantoic fluid of infected chick-embryos was rich in virus. This important observation was made in 1940 and used as a basis for the preparation of vaccine in the following year. Since that time, preparations of influenza vaccine have consisted either of unconcentrated allantoic fluid from infected embryos or of concentrated allantoic fluid. The methods of concentration have included separation of the virus from the fluid by adsorption on chick red blood cells, with subsequent elution of the virus from those cells. Other methods consist of adsorption of the virus on precipitates formed in the allantoic fluid upon the addition of alum, calcium phosphate, protamine, or other agent.

In Canada, studies on influenza have been carried forward since 1935 in the Connaught Medical Research Laboratories, where important contributions have been made by Hare and McClelland on methods of concentrating the virus by adsorption on chicken erythrocytes. Field trials also have been conducted, using various vaccine preparations. These studies and those of other investigators have shown that the use of concentrated vaccines in man elicits a definite antigenic response and indicate that a certain amount of virus antigen gives rise to a maximum serological response and that marked local or general reactions follow the administration of too large a quantity of antigen.

An important advance in the preparation of vaccine has been made by Stanley, who sedimented the virus by high-speed centrifugation. Highly concentrated vaccines have been prepared by this method, and the use of chick red blood cells has been unnecessary.

Henley and his associates in the University of Pennsylvania have included, in a recent paper outlining their studies, a very helpful summary of experiments on the vaccination of human beings against influenza. They discuss, among other problems, the effect of single and multiple administrations of vaccine, comparison between immunizing capacities of vaccine prepared from allantoic fluid with and without concentration and the persistence of antibody levels, as well as attempts to extend the period of protection. It is their opinion that one dose of effective antigen elicits as marked a response in increasing the antibody titre as do multiple doses.

Much more data have yet to be obtained about the persistence of antibody levels following vaccination, particularly with the newer vaccine preparations in which concentration is accomplished by centrifugation. Following the administration of a potent vaccine, the antibody titre rises to a peak in a few weeks, but falls rather rapidly in the subsequent weeks and months. In the field reports which have indicated that the vaccine was of value, the exposure (occurrence of an epidemic) was within a few weeks of the time of vaccination. It is not known how long protection is afforded. In certain investigations,

comparing protected and unprotected groups, the superiority of the vaccinated group was six-fold in the second week after inoculation but less than two-fold in the seventh week. Reference is made also to attempts to prolong the effect of vaccination, as measured serologically, by combining alum and other adjuvants in the vaccine. Some of the adjuvants have given encouraging results but much more work needs to be done before conclusions can be drawn. Salk and his associates believe that vaccination is of definite value in the prevention of the disease during a period of a year from the time of vaccination. Although the antibody level may fall well below the "protective level", as tentatively suggested by serological studies, it is not known that the individual is then susceptible to influenza.

To obtain information in field trials is extremely difficult. Comprehensive studies based on the expectation of a subsequent epidemic have been undertaken, but many have not afforded information because the disease in epidemic form did not occur. Influenza vaccine was used extensively in the United States Army but the results have not yet been made public. Observations in a group of three thousand vaccinated men and over three thousand controls during the winter of 1943-44 appeared to indicate an incidence one-third of that among the unvaccinated. Little information is available in regard to the protection afforded by the vaccine (A and B) against virus B infection. Last spring, Francis, Salk and Brace reported findings relating to a group of six hundred Army students in the University of Michigan. There, the respective incidence rate was 99 per 1,000 for the unprotected and 11 per 1,000 for the protected group. They conclude: "The evidence clearly indicates that subcutaneous vaccination with inactivated influenza virus types A and B exerted a striking protective effect against epidemic influenza B."

As previously stated, the vaccine is expensive at present to prepare, and, therefore, even if its value was fully established, its widespread use as a public health procedure would not be generally considered. It is accepted that a definite antibody response follows the administration of a potent vaccine and that one dose appears as effective as several. The antibody level drops rapidly after an early initial peak but it is thought that vaccination in the fall would have some protective value during the winter and spring months, possibly longer.

Reactions may occur in individuals who are sensitive to chick proteins. In general, the local reaction is comparable to that following typhoid—paratyphoid vaccine. Newer preparations of centrifugated vaccines may give less reaction.

Important advances have been made, and the preparation of an effective vaccine against influenza appears to be in sight. However, in the light of the present information, the action of commercial laboratories which prepare influenza virus vaccines in urging widespread use does not seem to be justified.

PUBLIC HEALTH EDUCATION

A NATIONAL HEALTH FILM SERVICE

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IN Canada today many methods and many media are being used by health educationists to inform our citizens and to increase knowledge and understanding of personal hygiene and public health. Not the least of these media is the motion picture film, the role of which is becoming increasingly important in health education. A great many health films have been produced over the past ten or fifteen years on this continent and in the United Kingdom. They have been made under the sponsorship of many different organizations, and some have even been made with a primary purpose other than health education. Today some of these films are still of value, while many are practically worthless by reason of being out-of-date or of an inferior cinematic quality. Visual education for health has involved a first task of separating the grain from the chaff.

At the September 1944 meeting of the Dominion Council of Health the question of a national library of health films was raised, and the National Film Board was requested to look into the problem. As a result, a survey of the health film field was begun. Through a film-reviewing committee headed by the Deputy Minister of National Health, close co-operation with the Council has been maintained. Films on health subjects are screened periodically for this committee, which then reports to the Council and to the National Film Board their comments on each film and their recommendations as to whether it warrants inclusion in the health film library and as to the types of audience for which it is most suitable.

On the basis of these recommendations, the Department of National Health and Welfare and the National Film Board have been building up a reference library of films which are felt to be of real value to health education in Canada. The library now contains over one hundred titles, covering such subjects as sanitation, maternal and child care, nutrition, industrial health and safety, immunization, venereal diseases, first aid and safety, and personal hygiene. The following are a few representative film titles: HASH-SLINGIN' TO FOODHANDLING, a color film on restaurant sanitation; THE CHILD HEALTH CONFERENCE, a film showing the organization and functioning of a well baby clinic; YOUR CHILDREN'S EYES, YOUR CHILDREN'S EARS and YOUR CHILDREN'S TEETH, three films produced in

the United Kingdom and designed primarily for parent audiences; EYES FOR TOMORROW, dealing with the causes and prevention of blindness and the conservation of sight; MEN IN DANGER, dealing with industrial accidents and occupational diseases and their prevention; DEFENCE AGAINST INVASION, a Walt Disney film explaining the principles of immunization; CHILDREN FIRST, describing the nutritional role of milk and its importance in children's diet; WHEN DO WE EAT?, a nutrition film directed to the industrial worker.

Until recently the library has been used solely for preview and reference purposes by Provincial health departments and other national organizations, enabling them to locate and purchase worthwhile films for their own use. However, in order that it might better serve the interests of health education in Canada, and to provide a more general distribution of the films, the National Film Board has placed the library with the National Film Society of Canada, where it is available to all interested groups. The National Film Society is a non-profit educational organization, not connected with the Canadian government, having for its main object the extended use of educational and cultural films in Canada. The Society maintains one of the film libraries which has served for several years as a repository of National Film Board releases, and it distributes films throughout Canada.

The health film library is being distributed on a service charge basis, as follows. Black-and-white films are available at a charge of 50c per reel, and color films for $1.00 per reel, for each day of use. Requests should be addressed to the *National Film Society of Canada, 172 Wellington Street, Ottawa.* Films will be shipped express collect and should be returned express prepaid. Where departments of health and other organizations desire to obtain their own prints of health films, the Society offers free preview of the films concerned. In such cases, requests should clearly state that the film is desired for preview with a view to purchase.

Lists of the available films may be obtained from the Society and from the Health and Medical Films Section, Distribution Department, National Film Board, Ottawa. From this latter source may also be obtained a complete catalogue-listing which indicates the title, year of production, whether sound or silent, black-and-white or color, running time, producer-distributor, approximate per-print cost, and a catalogue description of each film, together with the comments of the reviewing committee.

In addition to distribution through this national health film reference library, films dealing with public health are from time to time included on the programs of the National Film Board's rural circuits. This type of distribution is expected to increase as more up-to-date films, several of which are now in production, become available. After such films have completed their circuit showings, the prints are placed on extended loan in regional and community film libraries across Canada where they are available to community groups, schools, etc.

Equipment for showing films is, of course, as necessary as the films themselves. Close to a hundred urban communities across Canada have established volunteer projection services sponsored, in the majority of cases, by

either the local Junior Chamber of Commerce or a Community Film Council. Such services provide, without charge, a projector and operator for the showing of educational films. For full information on these facilities in your community, contact the regional offices of the National Film Board in any of the following cities: Halifax, Charlottetown, Fredericton, Quebec City, Montreal, Toronto, Winnipeg, Regina, Edmonton, Vancouver. In rural areas the National Film Board's circuit field men are always glad to co-operate in any welfare project by assisting in planning film utilization and providing projection facilities.

Thus the first steps have been taken toward more adequate distribution of health films in this country. It is now becoming possible to see in what direction future efforts in the production and distribution of health films should be aimed, and it is hoped that all organizations concerned with health education will give increasing attention to the visual aids which are now available and to the potentialities of visual education for health.

CORRESPONDENCE

To the Editor:

I have been interested in Dr. A. R. Foley's article on combined diphtheria toxoid and pertussis vaccine, published in the July number of the Canadian Journal of Public Health, and also Dr. Fraser's editorial in the same issue.

Nearly all the immunization against communicable diseases for this city has been done in the city's Health Department for more years than I care to mention. A very few physicians in private practice do some in their office. I am more convinced than ever that a pre-school clinic for immunization in the city health department is the most reasonable way to prevent communicable diseases, and for the following

1. The fact that the child is brought by the parent to the clinic dispels any doubt of the parent's desire to have the immunization done. It is also our experience to find that parents like the combinations of toxoid and vaccines (or mixed antigens) simply because it means fewer visits to the clinic; and the complaints about reactions, we find, are not any more numerous than when the products are given separately.

2. The immunization is done at an early pre-school age to prevent infection, at a time when it may be more likely to be fatal than during school age.

3. Pre-school immunization prevents loss of school attendance from sickness and also waste of time from classes for immunization. For this reason it is popular with both parents and teachers.

4. Dr. Fraser, in his editorial, raises the question of the most practical method of recording what vaccines have been given to the child. For a city of 50,000 it is feasible to keep the record of immunization against communicable diseases of every child. Records have been kept in this city since 1926. We are constantly receiving requests from parents living outside the city for copies of records to be mailed to them. Persons making application for institutional work, such as hospitals, frequently write and ask this Department for records of immunization. The keeping of records is important for information about the proper time to give reinforcing doses.

Once a clinic for immunization of pre-school children is well established in the health department, people form the habit of visiting for this purpose without much necessity for publicity in

the press. Special efforts to give publicity, like "National Immunization Week", assist in prevention, because the health department is prepared to do the work. Publicity campaigns for a communicable disease for which there is no immunization, as poliomyelitis and encephalitis, or where no provision has been made for free immunization of preventable diseases, is practically useless; it may even do some harm. Every year the daily papers feature some of these news items, and the public-health value of such seems to me to be questionable.

ARTHUR WILSON, M.D.
Medical Officer of Health
Saskatoon, Saskatchewan

BOOKS

Medicine in Industry. *By Bernhard J. Stern, Ph.D. Studies of the New York Academy of Medicine Committee on Medicine and the Changing Order. New York: The Commonwealth Fund, 1946. 209 pp. $1.50.*

THIS BOOK, one of a series of studies of the Committee on Medicine and the Changing Order, New York Academy of Medicine, is a useful contribution to public health literature.

The author has summarized in some detail the historic developments in the field of industrial medicine. He has made a very clear picture of the improvements made in the standards of living as a result of industrialization, with a consequent improvement in the level of general health. At the same time he has outlined in useful detail the new health and medical problems which have resulted from industrialization. The extent to which workers have been exposed to toxic materials, to unhygienic working conditions, to fatiguing and hazardous occupations in the United States is described.

Dr. Stern has traced the social, economic, legal and professional setting within which industrial medicine has progressed. He contrasts, by convincing statistics, the extent of industrial disability with the meagre preventive services now in use. Health insurance plans as applied to industrial groups in the United States are summarized. The problem of health supervision of employees with particular reference to rehabilitation and the problems of the handicapped in industry are clearly outlined. The relationship of the industrial physician to the general practitioner and the profession is discussed.

The findings of the study lead to the conclusion that, although great advances have been made in recent years, adequate medical care for the mass of workers in the United States is still to be provided. That industrial medicine offers an important contribution to preventive medicine and public health is clearly indicated.

For those concerned with the administrative aspects of adult health supervision, this is a most useful presentation. A comparable survey of industrial medicine in this country would certainly be desirable.

W. H. Cruickshank

Medical Care Insurance. A Social Insurance Program for Personal Health Services. *Report from the Bureau of Research and Statistics, Social Security Board, to the Committee on Education and Labor, United States Senate, July 8, 1946. Senate Committee Print No. 5, 79th Congress, 2nd Session. Washington: United States Government Printing Office, 1946. 185 pages.*

THIS REPORT was prepared under the direction of Mr. I. S. Falk, Director of the Bureau of Research and Statistics in the Social Security Board, and was submitted to the Senate Committee on Education and Labor, upon the request of Senator Murray, Chairman of the Committee. It presents, in detail, a proposed outline of a national medical-care insurance program for the United States and discusses, impartially, important alternatives to each item of the proposal. The report is the most comprehensive work that this reviewer has read on the subject, and contains, in addition to the proposed American plan, comments and facts regarding existing health and medical-care programs in other countries.

Opponents of any form of prepaid medical

care will state that the report is based upon an erroneous assumption, i.e. that there is a need for prepaid medical care. However, those who admit the need will find the report invaluable as a factual source of reference regarding all phases of compulsory medical-care insurance projects, and those interested in the present-day controversy regarding the need for such programs should make a point of reading the report.

J. H. Baillie

The 1945 Year Book of General Medicine. *Edited by George F. Dick, M.D.; J. Burns Amberson, M.D.; George R. Minot, M.D., S.D., F.R.C.P.; William B. Castle, M.D., S.M.; William D. Stroud, M.D.; and George B. Eusterman, M.D. Chicago: The Year Book Publishers Incorporated, 1945. 768 pages. $3.50.*

THE BOOK fulfils its intention to make available to all members of the medical profession the recent, important contributions to medical science and practice in the various fields. This it does in concise form but without loss of interest or practical value. The editorial notes accompanying many of the abstracts, coming from the pens and experience of outstanding authorities, are an excellent feature.

The material dealt with in each section is notable for its variety and high calibre. For example, in Part I, devoted to infectious diseases, the recent investigations and war experiences with hepatitis are brought up to date and help to clarify what has been a most confused picture. Stimulating reading is presented in the abstracts relating to poliomyelitis. Some twenty-three pages are given over to the subject of penicillin and its use and value in a wide variety of conditions. To the general practitioner this should represent a convenience of great appeal.

F. O. Wishart

ABSTRACTS

Epidemiology and the Psychosomatic Affections

A SEARCHING EXAMINATION is presented of the life of the child and adult of Britain from 1870 on and an attempt is made to correlate the great increase in psychosomatic affections with the profound changes occurring in social structure in this period. Thus, it is suggested that changes affecting the child such as infant-feeding practices, education, size and structure of the family, to mention only a few, have tended in the direction of "increasingly frustrated emotional development." Changes profoundly affecting the adult, notably the increased urbanization, disregard of individual working rhythms, the machine age with its departure from creative manipulation and periods of mass unemployment, have resulted in gross insecurity both social and economic. Accompanying these changes and of no little importance has been a decline in religious faith and a loss of purpose or aim in life. It is suggested, reasonably, that these changes have produced a great increase in predisposition to psychosomatic affections and have also provided the precipitating situations.

Cognizance of these influences and their psychosomatic end-products constitutes a large part of what is called "social medicine". That such problems belong within the purview of public health is now well recognized. Preventive measures must stem from a consideration of the aetiology as it relates to child and adult. Because of the size of the problem and the numbers involved, corrective efforts must be susceptible of broad application, not confined to individuals. Thus, in regard to the child, personality development should receive emphasis equal to that placed on physical welfare. A communal approach to adult psychosocial problems, such as unemployment and other insecurities which promote inefficiency, unhappiness or illness, is essential. *James L. Halliday, The Lancet, 1946, II: 6415.*

Refrigeration in a Food Control Program

PUBLIC-HEALTH workers connected in any way with food inspection and control should read this article. In it are pointed out the many details which are concerned in adequate refrigeration and which may be overlooked through blind reliance on the mechanical nature of the equipment. Thus, in over 300 restaurants surveyed, refrigerator tempera-

ture exceeded 50°F. in 26 per cent. Adequate refrigeration should be judged on the basis of the kind of business conducted, restaurant or retail and so forth, and the amount and kind of foods to be stored, as different foods, such as meats, dairy products and fruits, require different temperatures.

Faults in the operation of refrigeration are pointed out. These may consist of too frequent opening, giving rise to temperature fluctuations; overcrowding and poor dispersal of foods in the refrigerator leading to interference with air circulation; improper connection of drains; lack of attention to odours, cleanliness and so forth. Corrective measures to be adopted in each instance are pointed out. Of great interest is the discussion on the use and misuse, value and limitations of ultra-violet light in conjunction with refrigeration.

H. S. Adams, Am. J. Pub. Health, 1946, **36**: *1007.*

Penicillin in Treatment of Severe Diphtheria

A SERIES of thirteen cases of severe diphtheria was treated with systemic penicillin in addition to antitoxin. A second (control) series of fourteen cases received antitoxin only. The severity was somewhat less on the average in the control group; otherwise the cases were closely comparable. While the numbers involved were too small to warrant final conclusions, it was apparent that in this study those receiving penicillin fared better than the controls. Thus, in the penicillin group, nine of the thirteen escaped paralysis completely whereas in the control group only four of the fourteen escaped paralysis. Again, in the penicillin series, there were only three cases of clinical myocardial involvement as against nine in the controls. Penicillin appeared to exert little effect on the clearance of the membrane but the incidence of complications appeared to be lessened, the toxæmic state shortened and the length of stay in hospital reduced.

Richard J. Dodds, Brit. M. J., 1946, July 6: 8.

Cerebrospinal Meningitis

ONE hears so little of meningococcal meningitis that this account is full of interest and surprise. For instance, in the United States the incidence of this disease reached a record high rate in 1943 and was almost equally high in 1944. Such increase is the usual accompaniment of war and mobilization of troops and was experienced by most countries for which statistics are available in both of the world wars as well as in lesser disturbances. Between the two great wars, four distinct epidemic periods occurred in the United States and one or more minor epidemic waves in most other countries.

In the States of Massachusetts and New York, where records are available since 1873, epidemic waves show a downward trend in both cases and deaths since 1905. Case fatality rates likewise show a decline, which is sharply accelerated with the advent of the sulfonamide era. In spite of this amelioration in the behaviour of the disease, it accounted for 21,246 deaths in the period 1930-39 in the United States. This total is about equal to the number of deaths from scarlet fever and more than twice the number of deaths from poliomyelitis for the same period.

Mary Gover, Pub. Health Rep., 1946, **61**: *433.*

Laboratory Diagnosis of Weil's Disease

THIS paper presents a general discussion of the problem of leptospirosis in addition to laboratory data. In a six-year period, 1940-1945 inclusive, 1,120 human sera were examined for agglutination of *L. icterohaemorrhagiae* and 182 were found positive. The disease was found to occur at any time of year but was most common in the late summer and autumn. This peak in the curve is apparently accounted for by cases infected while swimming in waters polluted with rats' urine, such as sluggish rivers and canals. The occupational incidence was of interest and showed the following pattern among civilians: colliers, 18.0 per cent; farm workers, 8.0 per cent; bathing and accidental immersion, 8.0 per cent; sewermen, 4.0 per cent; butchers, 3.3 per cent and fishworkers, 1.3 per cent. Recognition of the seasonal and occupational hazards is important in diagnosis since a high proportion—40 to 60 per cent of cases—remain anicteric and early laboratory confirmation is essential for proper serum and chemotherapeutic treatment. With better diagnosis of anicteric cases, a truer and lower mortality rate has become evident.

A. D. Gardner and J. A. Wylie, The Lancet, 1946, I: 955.

Fourteenth Annual Christmas Meeting

OF THE

LABORATORY SECTION

Canadian Public Health Association

WINDSOR HOTEL, MONTREAL

DECEMBER 16-17, 1946

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Preliminary Program

MONDAY MORNING, December 16th

9.00 a.m.—Registration. A fee of $1.00 is charged to cover in part the expenses of the meeting.

Tickets for the dinner Monday, 7.30 p.m. will be available at the Registration Desk. Early reservations are desirable as the accommodation is limited.

Registration Desk: Outside Salon E.

SALON E, 10 A.M.

1. **Proteus Antisera with Special Reference to the Differentiation of Regular and Variant Forms of Salmonella pullorum.**

   DR. RONALD GWATKIN, Dominion Division of Animal Pathology, Animal Diseases Research Institute, Hull.

2. **Salmonella Studies in Fowl.**

   F. E. CHASE, Department of Bacteriology, Ontario Agricultural College, Guelph.

3. **The K Formula Stained Antigen in the Detection of Standard and Younie Types of Salmonella pullorum Infection.**

   L. A. MCDERMOTT, Department of Bacteriology, Ontario Agricultural College, Guelph.

4. **The Incidence of Organisms of the Salmonella Group in Canadian Dried Egg Powder.**

   DR. N. E. GIBBONS, Division of Applied Biology, National Research Council, Ottawa.

Appointment of Nominating Committee.

5. **Typing of Bact. typhosum and Bact. paratyphosum B by Means of Bacteriophage.**

   JEAN-MARC DESRANLEAU, Division of Laboratories, Ministry of Health and Social Welfare of Quebec, Montreal.

6. **An Outbreak of Paratyphoid B Fever in the Nursery of a Small Hospital.**

   Dr. A. R. Foley, Ministry of Health and Social Welfare of Quebec, Quebec City.

7. **Experience with Salmonella Typing in Canada.**

   Drs. L. E. Ranta and C. E. Dolman, Connaught Medical Research Laboratories (Western Division), the University of British Columbia, Vancouver.

MONDAY AFTERNOON, DECEMBER 16th

SALON E, 2 P.M.

1. **Studies of Complement Fixation with Influenza Virus Antigens by Quantitative Methods.**

   Dr. Christine Rice, Dominion Division of Animal Pathology, Animal Diseases Research Institute, Hull, Quebec.

2. **Ornithosis Among "Wild Pigeons" in Ontario.**

   Dr. N. A. Labzoffsky, Division of Laboratories, Ontario Department of Health, Toronto. (To be read by Dr. E. L. Barton, Director of Laboratories, Ontario Department of Health, Toronto.)

3. **Plague, Rocky Mountain Spotted Fever and Tularaemia Surveys in Canada.**

   F. A. Humphreys and A. G. Campbell, Department of National Health and Welfare, Kamloops Laboratory, Kamloops.

4. **Identification of Strains of Staphylococcus by Bacteriophage in Outbreaks of Food Poisoning.**

   A. M. Millar, Ontario Department of Health, Toronto.

5. **Allergy in Adults Vaccinated with BCG by the Multiple Skin Puncture and Scarification Methods.**

   A. Frappier and R. Guy, Institute of Microbiology and Hygiene, University of Montreal, Montreal.

6. **Schick and Moloney Tests in Adults.**

   L. Forte and A. Frappier, Institute of Microbiology and Hygiene, University of Montreal, Montreal.

7. **Cholesterolemia in Immunized Animals.**

   M. Panisset and J. Lapierre, Institute of Microbology and Hygiene, University of Montreal, Montreal.

8. **Bursting Action of Non-toxic Filtrates of Clostridium perfringens Cultures in Experimental Gas Gangrene.**

   V. Fredette and A. Frappier, Institute of Microbiology and Hygiene, University of Montreal, Montreal.

9. **Comparative Effects of Immunization with Live or Dead Vole Bacillus in Experimental Tuberculosis.**

   Paul Marois and A. Frappier, Institute of Microbiology and Hygiene, University of Montreal, Montreal.

10. Observations on Immunity to Protozoan Parasites in Birds.

DR. W. E. SWALES, Dominion Division of Animal Pathology, Institute of Parasitology, Macdonald College, Ste. Anne de Bellevue.

MONDAY AFTERNOON, DECEMBER 16th

6.00 P.M.—RECEPTION AT THE FACULTY CLUB OF McGILL UNIVERSITY

This reception, at which light refreshments will be served, is sponsored by McGill University. The Faculty Club is at 3450 McTavish Street, which runs north from Sherbrooke Street and forms the western boundary of the McGill campus. It is within ten minutes' walk of the Windsor Hotel.

MONDAY EVENING, DECEMBER 16th

Informal Dinner

OAK ROOM, 7.30 P.M.

Speaker: A. L. MACNABB, Principal, Ontario Veterinary College; Chairman, Laboratory Section.

Tickets ($2.50) will be on sale at the Registration Desk outside Salon E during the morning and early afternoon. Please purchase tickets at the time of registration in order that accommodation may be arranged.

TUESDAY MORNING, DECEMBER 17th

SALON E, 9 A.M.

Business Session

SALON E, 9.30 A.M.

1. Histological Differentiation of Actinomycosis and Actinobacillosis.

DR. P. J. G. PLUMMER, Dominion Division of Animal Pathology, Animal Diseases Research Institute, Hull.

2. The Isolation of Antibiotic Actinomycetes.

G. B. LANDERKIN, Division of Bacteriology and Dairy Research, Science Service, Department of Agriculture, Ottawa.

3. Effect of Medium Constituents on Toxin Production by Clostridium welchii.

DR. D. C. B. DUFF, Department of Bacteriology and Preventive Medicine, University of British Columbia, Vancouver.

4. Botulism, Type E, with Report of an Outbreak in Nanaimo, B.C.

DR. C. E. DOLMAN and MISS DONNA E. KERR, Division of Laboratories, Provincial Board of Health of British Columbia, Vancouver.

5. Comparative Skin Reactions to Human and Bovine Tuberculins in Guinea Pigs Sensitized with Various Acid-fast Strains.

DR. C. W. MCINTOSH and DR. H. KONST, Dominion Division of Animal Pathology, Animal Diseases Research Institute, Hull.

6. The Use of Mucoid Streptococcus pyogenes for the Detection of Hyaluronidase Liberated by Micro-organisms or Present in Tissues.

DR. R. G. E. MURRAY, Department of Bacteriology and Immunology, University of Western Ontario, London.

7. **Types of Diphtheria Bacilli in Canada.**

   Dr. E. T. Bynoe and Miss Dorothy E. Helmer, Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.

8. **A Comparison of Certain Serological Screen Tests Employed as Aids in the Diagnosis of Syphilis.**

   Benoit Rousseau, Division of Laboratories, Quebec Ministry of Health, Montreal.

9. **Experimental Aspects of Gas Gangrene with Special Reference to the Septicum Infection.**

   C. O. Siebenmann and Miss Helen Plummer, Connaught Medical Research Laboratories, University of Toronto.

10. **A Study of the Antitoxin Response to Small Doses of Diphtheria Toxoid.**

    Dr. Franklyn O. Wishart, Department of Hygiene and Preventive Medicine, University of Toronto, Toronto.

TUESDAY MORNING, DECEMBER 17th

SALON F, 9.30 A.M.

1. **A Method for Assessing the Sanitizing Efficiency of Quaternary Ammonium and Hypochlorite Products.**

   Dr. C. K. Johns, Division of Bacteriology and Dairy Research, Science Service, Department of Agriculture, Ottawa.

2. **The Newer Insecticides, Repellents, and Rodenticides of Value in the Field of Public Health.**

   Dr. C. R. Twinn, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

3. **A Family Outbreak of Lead Arsenate Poisoning.**

   Dr. J. Wyllie, Queen's University, Kingston.

4. **Calcium Content of Fluid Milk.**

   Dr. I. Hlynka, Division of Chemistry, Science Service, Department of Agriculture, Ottawa.

5. **Laboratory Control of Pasteurization Plants in the Province of Quebec.**

   Jacques Archambault, Division of Laboratories, Ministry of Health and Social Welfare of Quebec, Montreal.

6. **Practical Aspects of HTST Pasteurization.**

   Dr. A. R. M. MacLean, Dominion Dairies Limited, Montreal.

7. **The Significance of Micro-organisms In Frozen Fruits and Vegetables.**

   A. H. Jones, Division of Bacteriology and Dairy Research, Science Service, Department of Agriculture, Ottawa.

8. **The Maintenance of Food Quality by Low Temperatures.**

   Dr. J. H. L. Truscott, Department of Horticulture, Ontario Agricultural College, Guelph.

TUESDAY AFTERNOON, DECEMBER 17th

FIELD TRIPS

2.30 p.m.-4 p.m.

LABORATORIES OF THE QUEBEC MINISTRY OF HEALTH AND SOCIAL WELFARE

1570 St. Hubert Street.

Inspection of laboratories opened this year.

Note: It is planned to provide transportation to the laboratories from the Windsor Hotel at 2.30 p.m. Those making their own arrangements should take an east-bound St. Catherine street car, 3 or 3A; get off at St. Hubert Street and walk south.

4.30 p.m.-6.00 p.m.

INSTITUTE OF MICROBIOLOGY AND HYGIENE, UNIVERSITY OF MONTREAL

2900 Mount Royal Boulevard.

Inspection of laboratories followed by buffet supper.

Note: It is hoped that transportation can be provided from the Laboratories of the Ministry of Health. Those going directly to the Institute should take a north-bound 29 car on Bleury Street and get off at Maplewood and Louis-Colin. An alternative route is to take a west-bound 65 car, transfer at Côte des Neiges and Queen Mary to an east-bound 29 and travel to the corner of Maplewood and Louis-Colin.

2 p.m. ELMHURST DAIRY

7460 Upper Lachine Road, Montreal West.

This is designed for those particularly interested in the laboratory control of milk supplies. It is limited to 20 persons. Those interested are asked to place their names on the list at the Registration Desk on Monday. Transportation will be provided from the Windsor Hotel, leaving at 2 p.m.

OFFICERS OF THE LABORATORY SECTION
1946

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